
Calciophila, a New Genus in African Asclepiadeae (Apocynaceae, Asclepiadoideae), and Taxonomic Rectifications in *Cynanchum*

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ABSTRACT. During work for the *Flora of Somalia* account of Apocynaceae subfamily Asclepiadoideae, a new species of uncertain affinity was discovered. DNA analysis revealed that the new species, *Calciophila gillettii* Liede & Meve, is most closely related to the recently described *Cynanchum galgalense* Liede, which was only provisionally included in *Cynanchum* L. after DNA analysis. As the best taxonomic solution for the two species not fitting into any of the known genera of milkweeds, the description of a new genus, *Calciophila* Liede & Meve, is proposed. Also, in the course of work for the *Flora of Somalia*, it was realized that *Cynanchum clavidens* N. E. Brown needs to be renamed *Cynanchum hastifolium* K. Schumann if the two taxa are considered to constitute subspecies of the same species, because *C. clavidens* has previously been put into synonymy with *C. hastifolium*. Finally, work on the *Flore des Seychelles* brought to light that *Cynanchum robertsoniae* Liede is identical with the Indian *C. callialatum* Buchanan-Hamilton ex Wight, and needs to be placed in synonymy with the latter. A lectotype is designated for *C. callialatum*.

Key words: Africa, Asclepiadeae, *Calciophila*, Cynanchinae, *Cynanchum*, Seychelles, Somalia.

During work on the *Flora of Somalia* treatment of Apocynaceae subfamily Asclepiadoideae, a specimen from the Botanical Museum of Uppsala University (UPS) could not be placed into any of the milkweed taxa known from there. While the small, leafless shrublet itself was sterile, a photograph clearly showing a *Cynanchum viminale* L. flower was attached, suggesting that the specimen constitutes a new taxon in the variable *C. viminale* group. However, closer examination revealed that the photograph could not have been taken from the plant on the specimen, because the size of the succulent shoot and its coloration did not match between specimen and picture. The plant itself was described on the label (*Thulin et al. 10122*, UPS) as having clear latex, a character so far unknown for the *C. viminale* group. On a second specimen obtained from the Kew Herbarium (K), luckily a few flowers were found. Size and structure of the extremely small flowers, together

with the clear latex, led to the inference that the plant might be possibly related to the *Blyttia* Arnott–*Diplostigma* K. Schumann–*Goydera* Liede complex in the Tylophorinae, whose members possess clear latex and very small flowers with a variable corona, and are well known from Somalia. We then obtained permission to sequence DNA from the UPS specimen in order to clarify the position of the taxon. It soon became clear that the plant is the closest known relative to *Cynanchum galgalense* Liede, which had been left in *Cynanchum* L. for its corona morphology even though molecular results did not support that position (Liede & Kunze, 2002); indeed the position of the two species in the Asclepiadeae is still puzzling.

MATERIAL AND METHODS

From the specimen *Thulin et al. 10122* (UPS), we managed to obtain DNA sequences of the regions commonly used in our lab for phylogenetic reconstructions, namely, ITS (nrDNA) and the *trnT-L*, *trnL-F* spacer and the *trnL* intron (cpDNA). In order to learn about the position of the specimen, two routes were followed. First, the sequences were inserted in recently published alignments of Asclepiadoideae (Astephaninae, Liede, 2001; *Cynanchum*, Liede & Täuber, 2002; African *Cynanchum*, Liede & Kunze, 2002; Tylophorinae, Liede et al., 2002). The datasets are available from the authors upon request. Second, a basic local alignment search tool (BLAST) search (Altschul et al., 1997) was conducted for each of the four partial sequences (Table 1).

RESULTS

The results of both approaches (cf. Material and Methods) show clearly that not only the morphological characters of the new species, but also its DNA characters constitute a mosaic between various taxa known from the area (Table 1). While there is little doubt that the closest relative to the new species is *Cynanchum galgalense*, another endemic from calcareous regions in Somalia, the position of the two species is less clear. Depending on the dataset, the two species are placed (1) on a polytomy comprising

Table 1. Results of the BLAST analysis of the four partial sequences of *Calciphila gillettii*.

	Name of the taxon with the most similar sequence (voucher)	Accession number of the most similar sequence	Score (bits)/% identity	Notes
ITS	<i>Cynanchum ellipticum</i> (Harvey) R. A. Dyer (Liede 2933, UBT)	AJ320444	646/94%	Positions 2–4 taken by other African <i>Cynanchum</i> species (score 638 bits/94% identity), <i>C. galgalense</i> (Thulin & Warfa 6205) only on position 5 (630/94%), again followed by two African <i>Cynanchum</i> species (624 & 622, respectively/93%) and <i>Schizostephanus alatus</i> (615/93%).
<i>trnT-L</i> intergenic spacer	<i>C. galgalense</i> (Thulin, Dahir & Osman 9433, UPS)	AJ492340	511/73%	Positions 2–21 (504–490/73%–72%) taken by Tylophorinae (e.g., <i>Tylophora heterophylla</i> A. Richard); the second specimen of <i>C. galgalense</i> (Thulin & Warfa 6205, K, UPS) ranges 22nd (490/72%).
<i>trnL</i> intron	<i>C. galgalense</i> (Thulin, Dahir & Osman 9433, UPS)	AJ492340	969/98%	Position 2 taken by the 2nd specimen of <i>C. galgalense</i> (Thulin & Warfa 6205, UPS) (954/98%), followed by several Metastelmatinae (e.g., <i>Metastelma schaffneri</i> A. Gray) and Tylophorinae (e.g., <i>Tylophora tenuis</i> Blume) species (906–888/96%).
<i>trnL-F</i> intergenic spacer	<i>C. galgalense</i> (Thulin, Dahir & Osman 9433, UPS)	AJ492342	692/98%	Position 2 taken by the 2nd specimen <i>C. galgalense</i> (Thulin & Warfa 6205, UPS; 658/96%), followed by <i>Schizostephanus alatus</i> (646/96%), and 16 Madagascan <i>Cynanchum</i> spp. (642/98%).

Oxystelma R. Brown (occurring together with *Solenostemma* Hayne), Tylophorinae, and Asclepiadinae (cpDNA datasets; Liede, 2001; Liede & Täuber, 2002), (2) in an association with *Schizostephanus* Hochstetter ex K. Schumann (Cynanchinae: cpDNA dataset combined with ITS; Liede & Kunze, 2002), or (3) in a sister-group position to the Tylophorinae (cpDNA dataset combined with ITS; Liede et al., 2002). As ITS sequences between Cynanchinae, Tylophorinae, and Asclepiadinae are so different that unambiguous alignments are impossible, no ITS alignment comprising members of all subtribes has been created.

Taking the isolated position of the new taxon and the character mosaic of the two sister species into account, it is considered taxonomically practical to distinguish the two species from *Cynanchum* L. as the new genus *Calciphila* Liede & Meve.

Calciphila Liede & Meve, gen. nov. TYPE: *Calciphila galgalensis* (Liede) Liede & Meve.

Plantae foliis carnosulis inferioribus caducis; latice pellucido; coronis gynostegialibus cyathiformibus vel urceolatis, partibus staminalibus interstaminalibusque late connatis, sulcatis; gynostegiis pyramidalibus; seminibus tuberculatis.

Pubescent, twiners or shrublets with small, fleshy caducous leaves; latex clear. Flowers very small, to

1.5 × 1 mm, rotate with corolla lobes ± erect to produce a cyathiform structure; gynostegial corona urceolate to cyathiform, consisting of staminal and interstaminal parts fused for at least 3/4 of total corona length, sulcate, emarginate; gynostegium pyramidal with oblique guide rails along the whole length of anthers, connective appendages triangular; pollinia pendulous, oblongoid; style head umbonate to tabular. Follicles thin-walled, fusiform; seeds tuberculate.

Distribution. Two species endemic to Somalia.

The new genus exhibits a unique mosaic of characters. Some characters, in particular a highly fused corona overtopping the gynostegium and the corolla lobes either glabrous or equally covered with verrucose trichomes, are also typical of *Cynanchum*. Other characters, in particular the clear latex and the fleshy caducous leaves, are very similar to some Tylophorinae genera, in particular *Goydera*, *Blyttia*, and *Diplostigma*. Ecologically, the new genus is characterized by its preference for calcareous soils, to which the genus name refers. All plants recorded to date were found only on limestone.

KEY TO THE SPECIES OF *CALCIPHILA* IN SOMALIA

- 1a. Erect shrublet with leaves to 2 mm long, shoots green; corolla purplish cream, glabrous; gynostegium stipitate, corona cyathiform. *C. gillettii*, new species

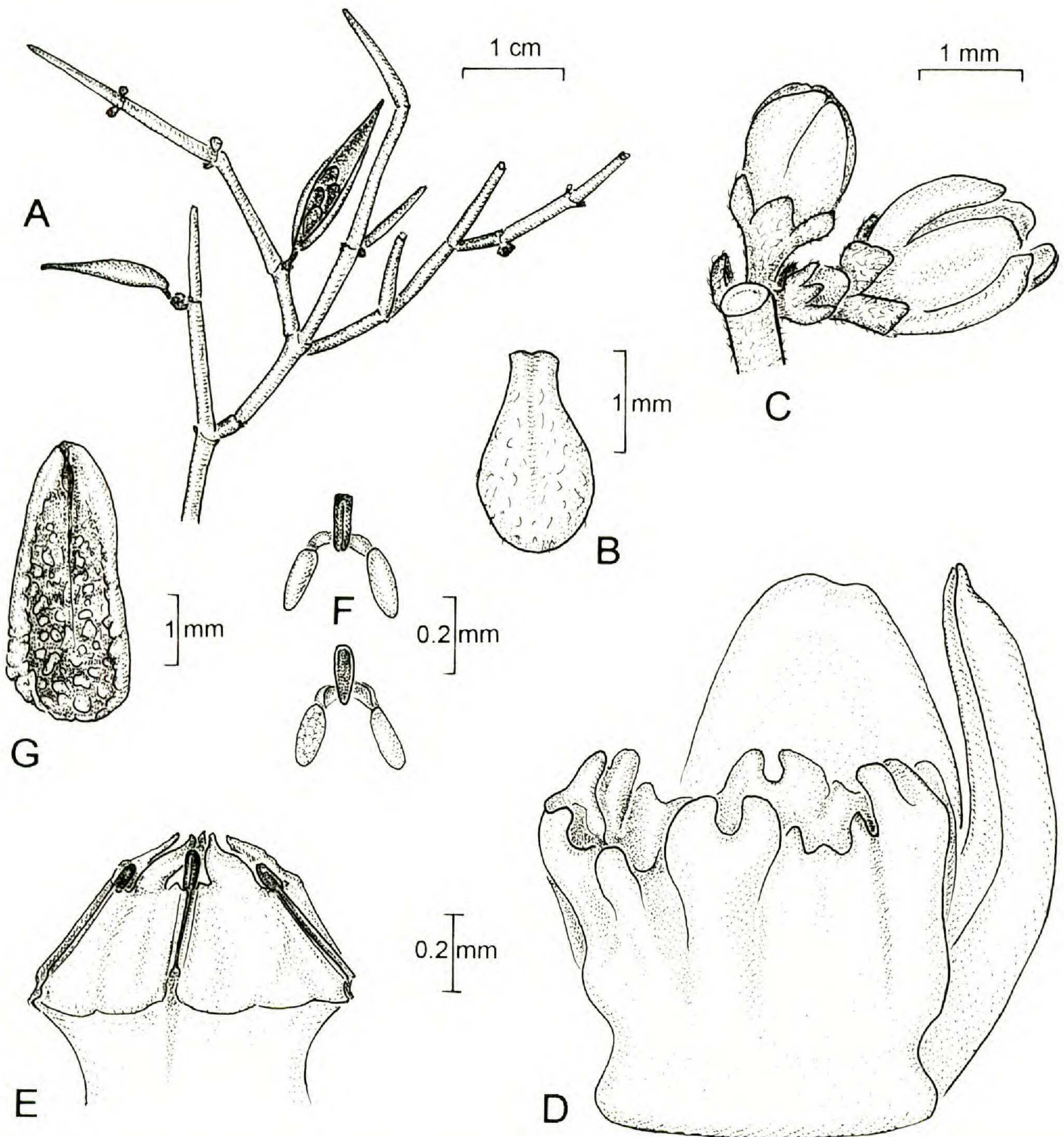


Figure 1. *Calciphila gillettii* Liede & Meve. —A. Fruiting branch. —B. Leaf. —C. Inflorescence. —D. Flower (corona in lateral view, calyx and parts of the corolla removed). —E. Gynostegium. —F. Pollinarium (top: frontal view; bottom: back view). —G. Seed (seta side). A & G from Thulin *et al.* 10122 (UPS); B–F from Gillett & Watson 23805 (K). All drawn by U. Meve.

1b. Climber with leaves 4–14 mm long, shoots yellowish to brownish; corolla cream-colored, with verrucose trichomes; gynostegium sessile, corona urceolate *C. galgalensis*

1. *Calciphila gillettii* Liede & Meve, sp. nov. TYPE: Somalia. Bari: rocky hill, 7 July 1981, *J. B. Gillett & R. M. Watson* 23805 (holotype, K). Figure 1.

Fruticuli nani, ramosissimi; caulibus virgatis, non volubilibus; foliis obovatis, succulentis, 1.5–2 mm longis, mox siccescentibus; corollis purpureis, glabris; coronis gynostegialibus cyathiformibus; gynostegii stipitatis. Differt a *Cynancho* speciebus caulibus viridibus, latice hyalino, a *Tylophorinarum* speciebus coronis late connatis.

Erect virgate shrublets, 5–40 cm high, richly branched; shoots perennial, woody to herbaceous, green, densely covered with recurved trichomes, 80 μm long; internodes 1–2.5 \times 0.15–0.3 cm; latex colorless; stipule-like short shoots absent. Leaves caducous, absent at the time of flowering, sessile, blades fleshy, 1.5–2 \times 1 mm, obovate, apically obtuse, marginally straight and thickened, adaxially and abaxially sparsely pubescent with recurved trichomes, 50–100 μm long; colleters absent. Inflorescences always one per node, extra-axillary, 3- to 10-flowered, 2 to 5 flowers open synchronously, sciadioidal, sessile; floral bracts 0.5 \times 0.3 mm, deltoid, with abaxial trichomes; pedicels 0.5 mm long.

densely pubescent with recurved trichomes, 100 μm long. *Floral buds* 1.5 \times 1 mm, globose to ovoid, with imbricate aestivation, dextrorse; *calyx* basally fused; with abaxial trichomes, lobes 0.4 \times 0.3 mm, triangular-deltate; *corolla* 1.5 mm long, abaxially cream, adaxially purple, lobes basally fused, 0.7–0.8 mm wide, ascending to erect, oblong, apically obtuse; *gynostegial corona* cyathiform, white, glabrous, ca. 0.9–1 mm long, consisting of connate staminal and interstaminal parts, exceeding the gynostegium and partly obscuring it; tube reaching more than 3/4 of corona length, with a slight basal constriction; staminal parts producing a pronounced convex fold along the upper half of corona, slightly cucullate, apically bifid with rounded apices, longer than the rectangular, \pm erect, emarginate interstaminal parts; *gynostegium* 0.9 \times 1 mm, atop a stipe of 0.3 mm; *anthers* broader than long, trapezoidal, abaxially convex; anther wings 350 μm long, extending along whole length of anther, consisting of distal and proximal ridge; anther wings of adjacent anthers parallel to each other, in the same plane as the anther; connective appendages 150 \times 120 μm wide, triangular, narrower than the stamen, strongly inflexed. *Pollinarium*: corpusculum 100 μm long, more than twice as long as broad, elliptic, margins of the corpuscular cleft parallel; caudicles 50 μm long, (sub-)basally inserted at the corpusculum, flattened, convexly recurved, rectangular; pollinia apically attached to the caudicles, 160–180 \times 60 μm wide, elliptical in cross section, oblongoid; *style-head* white, 0.4 \times 0.5 mm, upper part 0.1 mm high, shorter than the lower part, tabular. *Follicles* 1 per flower, erect to horizontal, 13–18 \times 2.5 mm diam., fusiform, terete, apically short-beaked, greenish light brown, uniformly colored, smooth, with dense indumentum, with papery pericarp; seeds ca. 4 to 8 per follicle, ca. 4 \times 1.8 mm, oblong, dark brown, tuberculate, papillose, marginally with 0.3 mm wing, multicellular in cross section, with enrolled margin; coma ca. 6 mm long, pure white.

Phenology. Flowering in July. Fruiting in January.

Distribution and habitat. Flat areas of limestone slopes, from 1300 and 1600 m, in Somalia. Often growing under larger shrubs; heavily grazed by goats.

Conservation status. Very localized, but common in its area (IUCN classification: EN B1a).

The insignificant habit of the new species, notable for its small, caducous leaves and tiny flowers to less than 1 mm diam., explains its long absence from the literature. Furthermore, the casual observer might easily mistake *Calciphila gillettii* for some species of

Asparagus L., *Euphorbia* L., or *Cynanchum* (former *Sarcostemma* R. Brown), and the very localized distribution area adds further to its obscurity.

Paratype. SOMALIA. **Bari**: Al Miskat, N Dasan in Dal loád area, 1600 m, Thulin, Abdi Dahir & Osman 10122 (K, UPS).

EMBL accession numbers of DNA sequences. ITS: AM229664; *trnT-L* intergenic spacer: AM229661; *trnL* intron: AM229662; *trnL-F* intergenic spacer: AM229663.

2. *Calciphila galgalensis* (Liede) Liede & Meve, comb. nov. Basionym: *Cynanchum galgalense* Liede, Ann. Missouri Bot. Gard. 83: 312. 1996b. TYPE: Somalia. Bari: Al Miskat Mts., ca. 15 km SW of Candala, Toh well, 2 Dec 1985, Thulin 5612 (holotype, K; isotype, UPS).

CYNANCHUM HASTIFOLIUM

Also in the course of the Asclepiadoideae treatment for *Flora of Somalia*, editor Mats Thulin (UPS) alerted us to the fact that Cufodontis (1960) gives a different nomenclatural history for the taxon described as *Cynanchum clavidens* N. E. Brown in Liede (1996b). Following the then most-recent edition of *Index Kewensis*, as well as Bullock's (1963) treatment of Asclepiadaceae for *Flora of West Tropical Africa*, Liede (1996b) attributed the name *C. hastifolium*—as well as *C. clavidens*—to N. E. Brown (1895). Cufodontis (1960), however, showed that *C. hastifolium* has to be attributed to K. Schumann (1895), who based it on a nomen nudum, *Cynoctonum hastifolium* Hochstetter ex Schweinfurth (1867), because the publication of Schumann (1895) took place in May and the one of N. E. Brown (1895) in October. Luckily, Cufodontis (1960) selected the type indicated by N. E. Brown (1895), *Schimper 1690*, to lectotypify *C. hastifolium* K. Schumann; however, he did so without explicitly stating that he (Cufodontis, 1960) was carrying out a lectotypification. Cufodontis (1960) also realized the conspecificity of *Cynanchum hastifolium* and *C. clavidens* N. E. Brown. Liede (1996b) came to the conclusion that *C. clavidens* and *C. hastifolium* deserve subspecific recognition, but unaware of the difference in time pointed out by Cufodontis (1960), she selected *C. clavidens* as name for the species, maintaining *C. hastifolium* at subspecific level as *C. clavidens* subsp. *hastifolium* (N. E. Brown) Liede. However, *C. hastifolium* K. Schumann has priority over *C. hastifolium* N. E. Brown and *C. clavidens* N. E. Brown, and therefore, *C. hastifolium* subsp. *hastifolium* has to be the typical subspecies, and the new combination *C. hastifolium* subsp. *clavidens* becomes necessary.

KEY TO THE SUBSPECIES OF *CYNANCHUM HASTIFOLIUM* IN AFRICA

- 1a. Style head well exceeding the corona, floral buds
6–6.5 mm long *C. hastifolium* subsp. *clavidens*
1b. Style head not or hardly exceeding the corona;
floral buds 3–4 mm long
. *C. hastifolium* subsp. *hastifolium*

1a. *Cynanchum hastifolium* subsp. *hastifolium*

K. Schumann, in Engler & Prantl, Nat. Pflanzenfam. 4(2): 253. 1895. *Cynanchum hastifolium* N. E. Brown, Bull. Misc. Inform. Kew 106: 257. 1895. *Cynanchum clavidens* subsp. *hastifolium* (N. E. Brown) Liede, Ann. Missouri Bot. Gard. 83: 306. 1996b. TYPE: Ethiopia. Prope Djeladjeranne, 29 Aug. 1840, *W. G. Schimper 1690* (holotype, K; isotype, P).

The taxon has seen a number of invalid descriptions, all attributing the name to Hochstetter: *Cynoctonum hastifolium* Hochstetter ex Schweinfurth (1867: 128), nom. nud., *Vincetoxicum hastifolium* Hochstetter ex Oliver (1888: 320), nom. nud. The name *Cynanchum hastifolium* was also attributed to Hochstetter by Schumann (1895) as “*C. hastifolium* (Hochst.) K. Schum.” Most likely, the taxon was intended for description by Hochstetter, as it can be deduced from the annotation of the type with a printed label, “*Cynoctonum hastifolium* Hochstetter,” but the description was obviously never published.

1b. *Cynanchum hastifolium* subsp. *clavidens*

(N. E. Brown) Liede, comb. et stat. nov. Basionym: *Cynanchum clavidens* N. E. Brown, Bull. Misc. Inform. Kew 106: 256. 1895; *Cynanchum flavidens* N. E. Brown, Index Kewensis Suppl. 1: 121. 1906, spelling error for *Cynanchum clavidens*. TYPE: Ethiopia. Ogaden: Boobi, 5 Feb. 1933, *F. L. James & J. G. Thrupp s.n.* (holotype, K).

CYNANCHUM CALLIALATUM

Lastly, in the course of studies for the *Flore des Seychelles*, Friedmann (1994) lists only one species of *Cynanchum* for the archipelago, a probably introduced Indian species, *C. callialatum* Buchanan-Hamilton ex Wight. Comparison of *C. robertsoniae* Liede, hitherto known only from the type, with this material and with Indian material, quickly revealed that *C. robertsoniae* is not, as the author thought, a rare relative of African *Cynanchum*, but a synonym of *C. callialatum*, for which a lectotype needs to be selected.

1. *Cynanchum callialatum* Buchanan-Hamilton ex Wight, Contr. Bot. India 56. 1834. *Cynoctonum callialatum* (Buchanan-Hamilton ex Wight)

Decaisne, Prodr. 8: 528. 1844. *Vincetoxicum callialatum* (Buchanan-Hamilton ex Wight) Kuntze, Revis. Gen. Pl. 2: 424. 1891. *Cyathella callialata* (Buchanan-Hamilton ex Wight) C. Y. Wu & D. Z. Li, Acta Phytotax. Sin. 28(6): 465. 1990. TYPE: India. *N. Wallich, Herb. Asclep. 83a* (lectotype, designated here, K).

Cynanchum robertsoniae Liede, syn. nov. Kew Bull. 50: 805–808. 1995. TYPE: Seychelles. Mahé, 13 Oct. 1936, *C. Osborne-Day 201* (holotype, BM).

The transfer of a group of taxa, including *Cynanchum callialatum*, to *Cyathella* Decaisne by Li et al. (1990), mainly for phytochemical reasons, has found no support by later workers and is not followed here. While their (Li et al., 1990) decision to separate *Vincetoxicum* Wolf from *Cynanchum* is well documented by morphological, phytochemical, and molecular data (e.g., Liede, 1996a; Liede & Täuber, 2002), the species of *Cyathella* in recent molecular analyses form a well-defined group within the larger *Cynanchum* clade and might deserve subgeneric or sectional status (Liede & Täuber, 2002), but cannot be considered an independent genus.

Wight (1834: 56) lists three syntypes for *Cynanchum callialatum*, “*Herb. Ham. ! n. 768; Wall. ! Ascl. n. 83; Wight. ! cat. n. 1551.*” The first of these, *Herb. Ham. 768*, could not be traced, and its presumed existence in CAL could not be confirmed. The second one, *Wall. Ascl. n. 83* is extant in the Wallich Herbarium of the Royal Botanic Gardens, Kew. It consists of two sheets, with *83a* and *83b* penciled on them. Number *83a* is the better of the two, with one flowering shoot and one fruiting one. The label has “*Cynanchum callialata*” and “*Botanical Garden 8 January 1815*” written in ink, and “*ascl.83.a*” written in pencil. As *Wall. Ascl. n. 83a* represents an easily accessible, complete, and well-preserved specimen, it is selected as lectotype for *C. callialatum* here.

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